
Space Weather Technical Forecast

Issued on Tuesday, 29 August 2023 at 13:15 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Slight chance of isolated M-flares (R1-R2 Blackouts) continues. Glancing CME arrival possible Day 2 (30 Aug) with slight chance of G1/Minor Storms.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low with only minor C-flares in the past 24 hours. There are five sunspot regions on the visible disc. Two of these are small and simple. Of the three main sunspot groups of interest AR3415, in the south central area, remains the most complex with a persistent delta spot configuration, but has remained largely inactive. The larger AR3413 rotating to the west of centre disk has continued to see small amounts of development to its multiple leading spots and continues to retain a north-south magnetic alignment. The new region in the far east, AR3417, has been classified as a Cso/Beta, though given the position rounding the limb any classification is low confidence, and more complexity may be revealed as it rotates further into view.

No new Earth directed CMEs have been seen in available imagery over the last 24 hours.

Solar Wind / Geomagnetic Activity: Solar winds, as observed by ACE/DSCOVR at L1, have been at background levels around 320-360km/s. Density was mostly average or just below. The interplanetary magnetic field, Bt, was primarily weak around 4nT, but with some enhancement from around 28/1700 UTC towards moderate levels of 8nT. The north-south component, Bz, started the period weakly negative (southward directed), around -5nT, then became solidly positive (northward directed) from 28/1700 UTC to a peak of +7nT, then recently became negative (southward) again, around -6nT from 29/0900UTC. Phi angle was predominantly positive (away from the Sun), but became negative (towards the Sun) from 28/1700 UTC. The above parameters are probably evident of a weak connection to CH38/- (no longer on disc) and HSS, although with some uncertainty. Geomagnetic activity was Quiet (Kp 0-1).

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux remained at background levels. GOES16 high energy (greater than 2MeV) electron flux was mostly at background levels. The associated 24-hour fluence was well below Active on a fairly steady trend, with 5.47e6 integrated pfu observed at 29/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low solar activity is expected to generally continue during the forecast period, but there is a slight chance of further isolated M-flares. A very slight chance of an isolated X-flare.

Solar Wind / Geomagnetic Activity: A CME may give a glancing impact at Earth sometime on Day 2 (30 Aug), though this is low confidence. There are no other Earth-directed CMEs currently forecast.

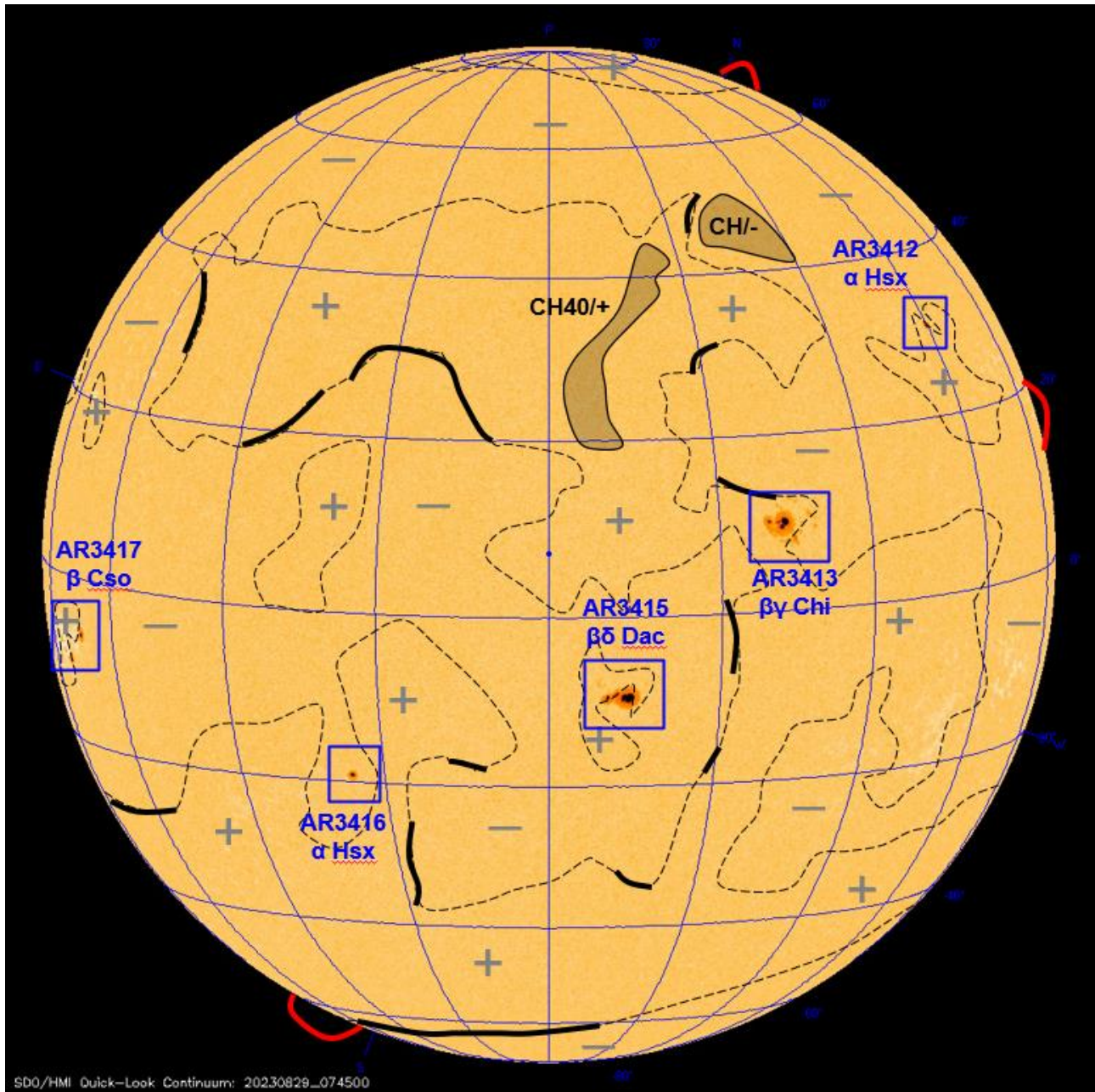
Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

Wind speeds are currently at background levels, and are expected to remain so until the potential CME arrival mentioned above. The next impact on the solar winds looks to be coronal hole (CH40/+) enhancement which may bring an increase in speeds to slightly elevated levels, 450-500km/s, into Day 4 (01 Sep).

Geomagnetic activity is expected to remain generally Quiet. If the CME glance occurs on Day 2 (30 Aug), activity may become Unsettled to Active with a slight chance of G1/Minor Storm intervals, with any effects easing into Day 3 (31 Aug) before potential coronal hole influence likely increases activity once again into Day 4 (01 Sep).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux is expected to remain at background levels, with just a slight chance of enhancement, mainly should any larger flares occur from AR3413 or AR3415. High energy (greater than 2 MeV) electron flux is expected to persist at mainly background levels, perhaps reaching moderate at the diurnal maxima. The associated 24 hour fluence is expected to remain below the Active level (1e8 integrated pfu).

Figure 1. Solar Analysis Valid 29/0745 UTC.



Key: Filament ____, Prominence ____, Magnetic Field Line - - -, Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α - β - $\beta\gamma$ - $\beta\gamma\delta$ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

The C2.2 flare and associated dimming from AR3413 at 25/1006 UTC likely produced a CME, with a very faint eruption subsequently detected in SOHO imagery. Assessment of this suggests a glancing CME impact is possible at Earth sometime on Day 2 (30 Aug) though this is low confidence. There are no other Earth-directed CMEs currently forecast.

Wind speeds are currently at background levels, with limited enhancement recently seen from the forecast CH38/-, and are expected to remain so until the potential CME arrival mentioned above. The next impact on the solar winds looks to be coronal hole enhancement from two northern hemisphere coronal holes, with particularly recurrent CH40/+ near centre disk forecast in Enlil output to bring an increase in speeds to slightly elevated levels, 450-500km/s, into Day 4 (01 Sep).

Geomagnetic activity is expected to remain generally Quiet. If the CME glance occurs on Day 2 (30 Aug), activity may become Unsettled to Active with a slight chance of G1/Minor Storm intervals, with any effects easing into Day 3 (31 Aug) before potential coronal hole influence likely increases activity once again into Day 4 (01 Sep).

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	5	20	5	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

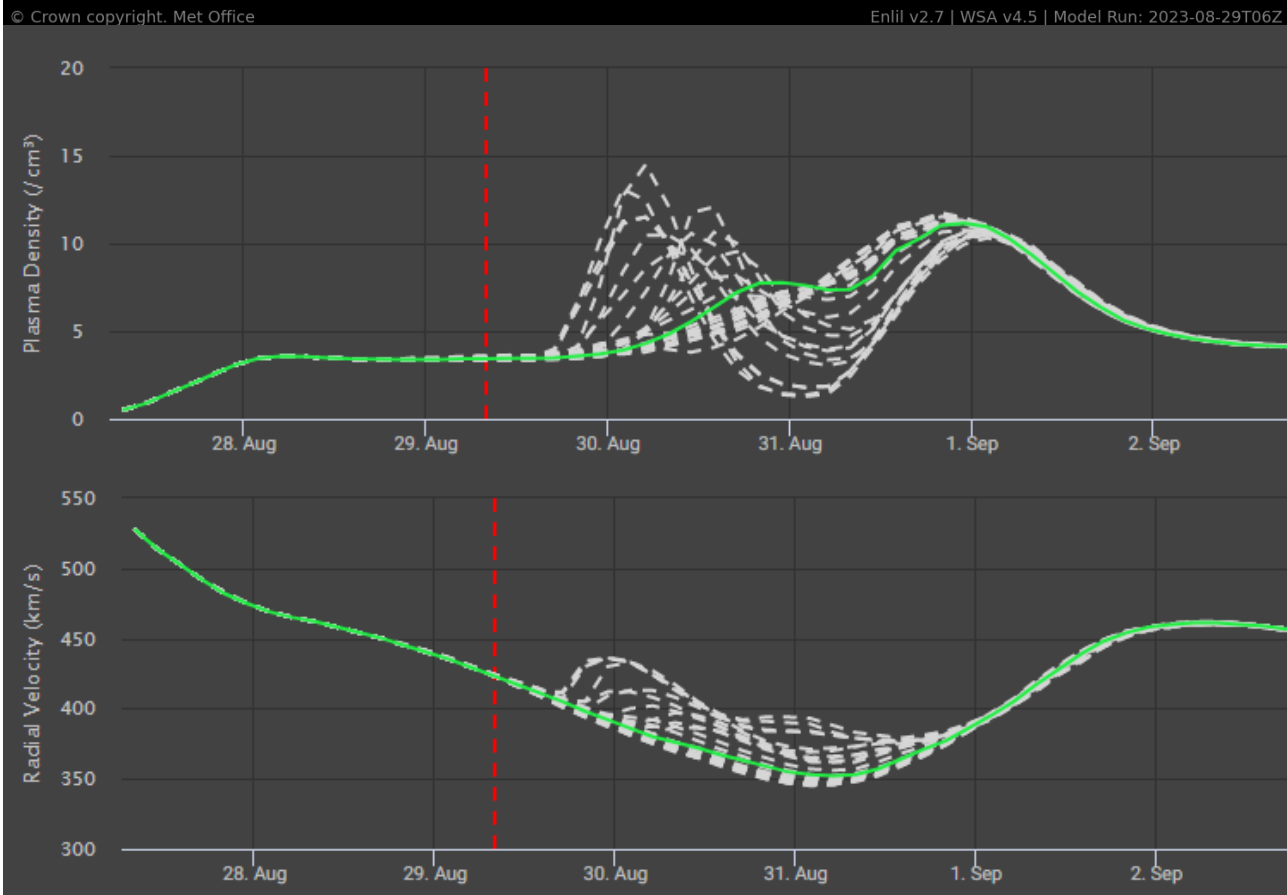
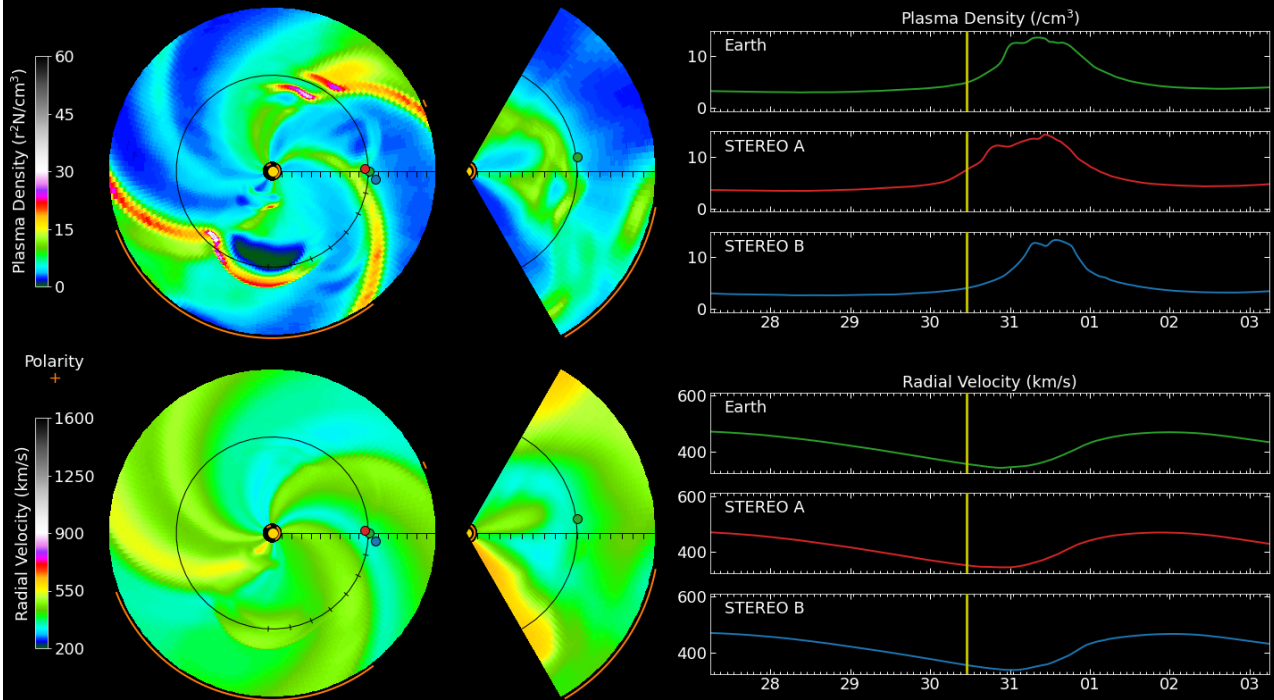
Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
26/1733	Partial	C2.2 flare	W-Centre disc	529km/s	30/1200 UTC +/- 10 hours	Low confidence

Figure 2: Latest ENLIL (top) and Ensemble (bottom) output, shows potential for a glancing CME during the 30th and CH/HSS enhancement by the end of the period.



2023-08-30 11:00:00



Radio Blackouts - X-Ray Flares:

The current low activity is expected to generally continue during the forecast period, but there is a slight chance of further isolated M-flares, either from AR3413/AR3415 or perhaps more likely from AR3417 in the far east given this spots history of recent M-flare activity. A very slight chance of an isolated X-flare is maintained given the size and complexity of AR3413 and AR3415, despite the lack of current activity.

There are five sunspot regions on the visible disc. Two of these are small and simple with limited flare risk expected. There are three sunspot groups of interest providing the bulk of flare risk. AR3415 (Dac/Beta-Delta) in the southeast continues with a persistent delta spot configuration, but has remained largely inactive with activity lower than the classification would suggest. The larger AR3413 (Chi/Beta-Gamma) rotating to the west of centre disk has continued to see small amounts of development to its multiple leading spots and retains a north-south magnetic alignment and some low level flaring. AR3417 region in the far east gave a long period M-flare on 26 Aug from over the eastern limb, so this region is one to watch with further magnetic looping visible in SDO AIA 171 imagery. All three features remain on the visible disk through the period with no significant oncoming regions expected.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	20	20	20	20
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 3: SDO/HMI intensitygram (left) and SDO/HMI magnetogram (right) shows AR3417 coming around the east limb.

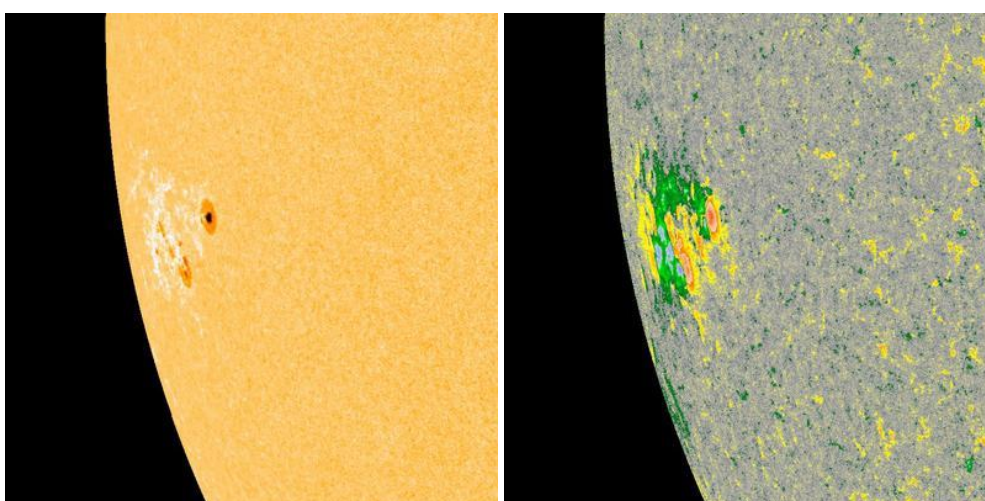
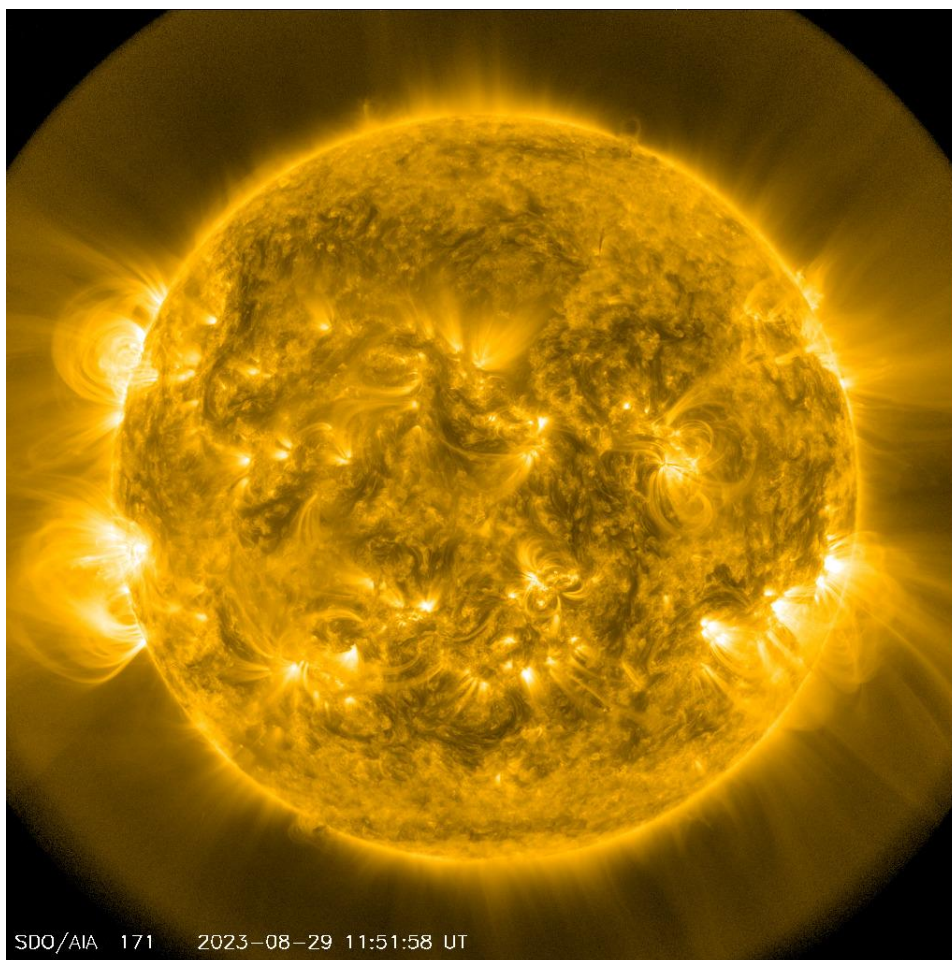


Figure 4: SDO/AIA 171 imagery shows magnetic looping associated with AR3417 in the east and a further area of looping in the northeast, which may be associated with another region due to rotate onto the disc.



Solar Radiation Storms - (High Energy Protons):

High energy (greater than 10MeV) proton flux observed by GOES16 is expected to remain at background levels with just a slight chance of enhancement. The main risk of any increased proton flux would be from the occurrence of any larger flares from AR3415 or AR3413, with these near centre disc and starting to transit through the western hemisphere.

Radiation Storms	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{s}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq \text{S1}$	No	5	5	5	5
Very Active	$\geq \text{S3}$ *	No	1	1	1	1

* S3 $\geq 10 \text{ MeV} \geq 1000 \text{ pfu}$ and / or $\geq 50 \text{ MeV} \geq 10 \text{ pfu}$. (pfu = $\text{cm}^{-2}\text{sr}^{-1}\text{s}^{-1}$)

High Energy Electrons Event ($\geq 2\text{MeV}$):

High energy (greater than 2 MeV) electron flux observed by GOES16 is expected to remain at background to moderate levels for much of the period, given a lack of recent electron enhancement. A possible CME glancing blow on Day 2 (30 Aug) and any associated geomagnetic activity could also keep flux levels suppressed.

The associated 24 hour fluence is expected to remain below the Active ($1\text{e}8$ integrated pfu) level, with any rise in fluence likely to be modest. This is supported by REFM, which currently seems to be a reasonable guide.

GEO Electron Environment	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{day}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^8$	No	5	5	5	5
Very Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^9$	No	1	1	1	1

Figure 5: MOSWOC REFM electron fluence, observations and recurrence data.

